

Socio-Economic Assessment of Hydro-Agricultural Development in Northern Togos Savannah

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Abstract: *This study focuses on evaluating the socio-economic implications of hydro-agricultural development within the fertile wetlands of the Savannah Region in northern Togo. By employing a comprehensive methodology involving field observations, documentary research, and interviews, the research assesses the socio-economic landscape of hydro-agricultural developments in lowland areas. The study data analysis, facilitated through Sphinx Plus2 V5 software and Excel 2016 spreadsheet, reveals a predominance of cereal production, specifically maize, sorghum, beans, and rice, with substantial yields. Furthermore, the research highlights the significant contribution of market garden crops, cultivated by both men and women, further enhancing the agro-economic landscape. The findings underscore the considerable potential of hydro-agricultural development in driving income generation and sustainable agricultural practices in the region.*

Keywords: Lowlands, socio-economic analyses, agricultural production, Savannah region

1. Introduction

Agriculture is an essential factor in economic growth. According to the World Bank (2022), it accounted for 4% of global GDP in 2018. In Togo, the agricultural sector employs nearly 65% of the working population and contributes over 40% of national GDP. Today, agriculture is faced with problems linked to climatic variability, such as irregular and insufficient rainfall. To overcome these problems, in addition to irrigation systems, lowlands and water reservoirs are an appropriate response to the problems of rain-fed agriculture in Togo. In the Savanes region, the demographic explosion has led to an increase in the area of farmland under cultivation. According to L. Y. Lare (1999), arable land is occupied and exploited on an ongoing basis. As a result, the depletion of arable land leads to emigration of the population, especially young people (K. Lare, 2021), and to the exploitation of lowlands and water reservoirs. The latter appear to be areas where agriculture can be secured, due to their particular hydrodynamic regime, notably the prolonged availability of water on the surface or in the soil (K. Lare, 2021). Although lowlands were once marginalized, the need for farmers to increase agricultural production and income has led to their increased exploitation (M. Biaou, 2012). They have gradually become an agro-economic potential for farmers. Indeed, the Savanes Region has significant lowland potential and a flood plain drained by several rivers, the most important of which is the Oti (G. Yarbondja et al 2023, K. Lare, 2021). In this context, practices are no longer based on prohibitions, but on recognition of the usefulness of these wetlands for food crops and market gardening (D. Lavigne *et al.*, 1996). These are agroecosystems where fertile land and the best water conditions can be found for the introduction of new agricultural productions such as arboriculture, rice growing, market gardening and fodder crops (A. Kindjinou, 2013). The lowlands and downstream areas of dams and watercourses in the Savanes Region are the most sought-after areas, thanks to their soils, which are relatively rich in organic matter, and the presence of water, which is the key element in agricultural activity (K. Lare, 2017, 2021). They are also a place where surface and underground runoff are

concentrated, making them ideal for production with more water-demanding varieties such as rice. The existence of shallow groundwater also enables the development of arboriculture and off-season market gardening supplied with water from shallow wells. The spread of ploughing, which facilitates the preparation of heavy soils, and climatic deterioration, which makes hillside cultivation and grazing unpredictable, have led farmers to make more systematic use of the lowlands, areas that are temporarily flooded. Moreover, lowlands are a source of food production and income for local populations. As a result, the development and intensification of farming activities in the lowlands has become an important issue for the rural economy of the Savanes Region. Inland valleys are not only a factor in food security (consumption of rice and market garden produce), but also an important source of monetary income for the various farmers. Food security and poverty reduction are nowadays a concern in every developing country in the world. Despite all the efforts made in Togo to alleviate poverty, 65% of the population of the Savanes Region still lives below the poverty line (INSEED, 2018). At the level of rural households, the strategies implemented by farmers consist of increasing productivity and developing a rural economy enabling them to achieve food security and increase their income. Market gardening and rice-growing are the agricultural sectors used to achieve this through the exploitation of lowlands. These findings raise the following questions: how does the use of lowlands contribute to the socio-economic development of the savannah region of northern Togo? The aim of this article is to show the contribution of lowland farming to socio-economic development in the savannah region of northern Togo. The aim is to analyze their impact on the socio-economic development of the Savannah Region.

2. Study Framework

The Savanes region is located in the northern part of the country. It lies between 0° and 1° East longitude and 10° and 11° North latitude. It covers an area of 8,470 km², or 15% of the national territory. The region is home to a population of around 114,3520 (RGPH5, 2022). It is the administrative

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region bordering Togo to the north, with Dapaong as its capital. It comprises seven prefectures: Cinkassé, Kpendjal,

Oti, Tandjouaré, Tône, Kpendjal-Ouest and Oti-Sud.

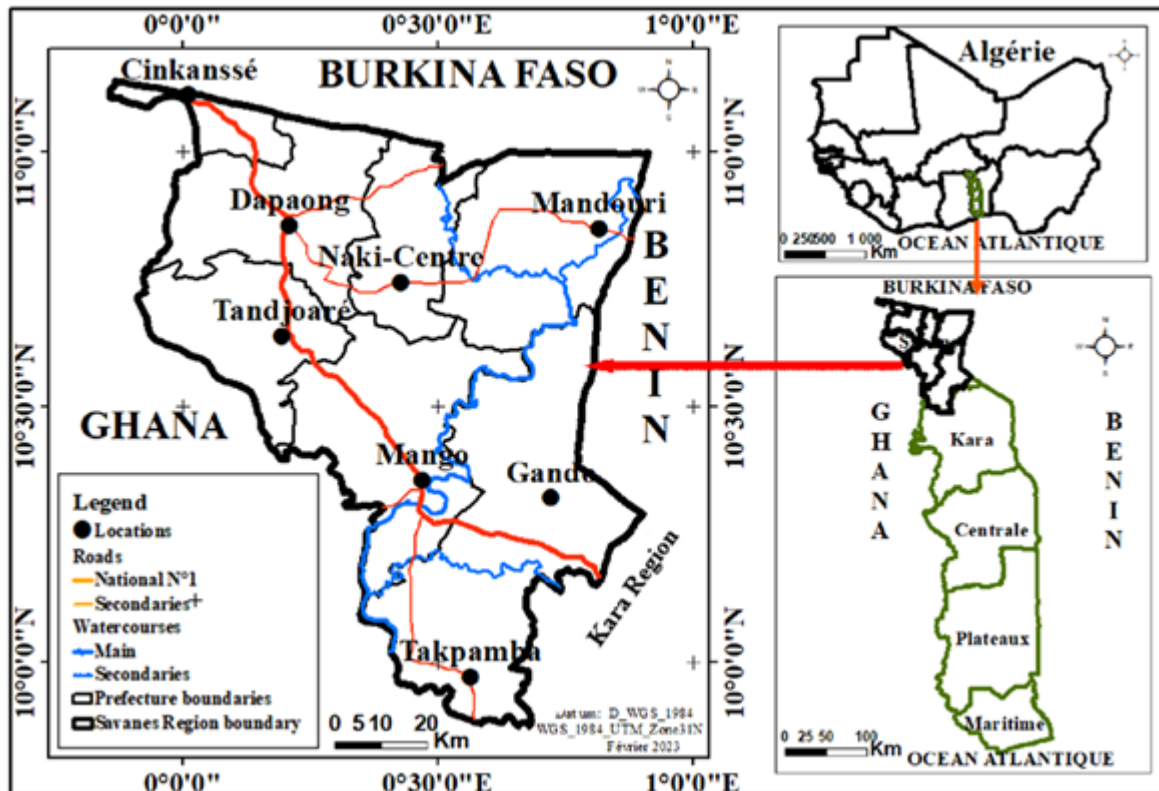


Figure 1: Location of study area

The environment is characterized by a tropical Sudanian climate, with a dry season from November to April and a rainy season from May to October. This climate is characterized on the one hand by the importance and duration of the dry season, which hampers agricultural and pastoral activities, and on the other by alternating air masses that impose an irregular and highly variable rainfall pattern. Annual rainfall ranges from 800 to 1000 mm, varies from year to year and is unevenly distributed during the agricultural season (K. Lare, 2021). Soils are derived from sandstone and granite-gneiss. They are shallow, fragile and often loaded with coarse elements. The most representative soils are ferruginous concretion soils, poorly developed erosion soils, poorly developed colluvial or alluvial input soils and hydromorphic soils (L. Baritse, 1986). These soils are generally fragile and subject to intense runoff during the rainy season. They are also threatened by human activity, notably vegetation fires, deforestation and the disappearance of fallow land. The plant species characteristic of the area include roan (*Borassus aetiopium*), shea (*Vitellaria paradoxa*), néré (*Parkia biglobosa*), tamarind (*Tamarindus indica*), acacia (*Acacia baileyana*) and baobab (*Adansonia digitata*). The fauna includes carnivores, panthers (*Panthera pardus*); herbivores, buffalo (*Syncerus caffer*), monkeys (*Chlorocebus sabaeus*) and partridges (*Perdix perdix*). The Savanes region is part of the Volta basin. The area is drained by the Oti River (167 km) and its tributaries, including Koumougou, Wapoti, Namiélé, Sansaragou, Nabounga, Bilangue, Biankoun and Koulogona. Numerous flood zones can be found all along the river. Other sources of water reserves are ponds. Numerous reservoirs have been built to alleviate water shortages for human and animal

consumption. The hydrographic network in the study area is irregular, with the exception of the Oti River, which has a flow rate of 100 m³/s and sometimes 500 m³/s during flood periods (K. Sokemawu, 2008). Four main activities characterize the economy of the savannah region. Agriculture accounts for almost 80% of the working population, followed by cattle rearing, fishing and trade. Food crops such as sorghum (*Sorghum bicolor*), millet (*Pennisetum glaucum*), rice (*Oryza sativa*), beans (*Phaseolus vulgaris*), maize (*Zea mays*), voandzou (*Vigna subterranea*) and yams (*Dioscorea alata*) dominate agriculture. These food crops are supplemented by export crops such as cotton, tobacco and groundnuts (Ministère du Plan, 1983). Agriculture in the region is marked by the fragmentation of agrarian space into family farming units (SEDES, 1976; Pilon, 2000). This production system, based on the principle of extensive land use and slash-and-burn farming, relies heavily on abundant labour and incorporates few commercial inputs (D. B. Ayivi, 2002). Farming techniques are traditional, and household size is the decisive factor in increasing agricultural production (K. Vignikin, 1992; DSID, 1998). The environment of the Savanes region is highly contrasted. The sparsely populated areas are mainly located in the geographical areas of good and average agricultural aptitude in the north-east, east and south-west of the region, with rainfall of up to 1100 mm per year. Moderately populated zones coincide with areas of poor agricultural aptitude in the North and West, with rainfall equal to or less than 1000 mm/year. As for the densely populated zones, located in the areas of average agricultural suitability in the extreme north and north-west of the region, rainfall is also less abundant (less than or equal to 1000 mm

of water per year).

3. Methodological Approach

To achieve the objective of this study, a methodological approach was adopted: documentary research and fieldwork.

Literature search

Documentation was also collected from the ministries in charge of water and agriculture, through the Water Resources Department and the Department of Planning, Equipment and Agricultural Mechanization. The aim was to gather statistical data on the region's population, agricultural production and food security. This documentary research was followed by field observations.

Data collection

In order to find answers to the questions posed in the present work, an in-depth survey was carried out on the lowland sites located in the 07 prefectures of the region, which were selected during the pre-survey in view of the importance of the farmers working there and the various activities carried out there. The aim of these surveys is to identify the agricultural activities carried out in these lowlands, the quantity of production and the income generated by these farms. The surveys targeted individual farmers and farmers' cooperatives. The number of people to be surveyed is determined by the formula of P. Dumolard *et al.* (2003): $n = t^2 \times p \times (1-p) / m^2$. Where n: minimum sample size required to obtain significant results for a given event and risk level; t: confidence level (the standard value for the 95% confidence level is 1.96); p: probability of occurrence of the event; m: margin of error (generally set at 5%). Thus, a probability of occurrence of 40% has been set, assuming a confidence level of 95% and a margin of error of 5%. Applying this formula gives a sample of 369 people, obtained as follows $n = 1.96^2 \times 0.4 \times 0.6 / 0.05^2 = 369$. Thus, 369 people were surveyed.

Sample size by stratum (production area)

The distribution of the sample size by stratum was based on the weight of each zone in terms of the number of producers. Thus, the sample size for each prefecture and production zone is obtained by multiplying the overall sample size by the weight of each stratum. The table below shows the complete sampling plan for the study.

Table 1: Complete sampling plan

No.	Production area	Producer Target		Number of respondents
		Cooperative	Individual	
1	Cinkassé	30	15	45
2	Tone	49	15	64
3	Tandjouaré	75	11	86
4	Kpendjal	7	11	18
5	Kpendjal West	14	12	27
6	Oti sud	27	12	39
7	Oti	70	20	90
TOTAL		272	97	369

Field survey

The field survey is carried out using a pre-designed questionnaire, which includes a number of survey variables. The data collected concerned the socio-economic characteristics of the farmers (the various products grown and their income, the areas farmed). Qualitative methods (directive and semi-directive interviews) were used to understand the functioning of the lowlands, technical itineraries, productivity, use of production and income. These interviews were conducted with farmers, heads of market-garden producer cooperatives, and agents from the Regional Directorate of the Ministry of Agriculture, Livestock and Fisheries.

Data processing equipment

The data collected during the survey was analyzed both qualitatively and quantitatively. The qualitative analysis mainly concerned data gathered through direct observation (illustrated by photographs) and interviews. Quantitative analysis was based on questionnaire data. Survey data were coded and entered into a database management matrix using Excel spreadsheets. Statistical analyses were carried out using Sphinx plus² 5. Maps were created using ArcGIS 10.8 and QGIS 3.20.

4. Results

Spatial overview of lowlands and water reservoirs in the region

The figure below (Figure 2) shows the spatial distribution of lowlands and reservoirs/dams.

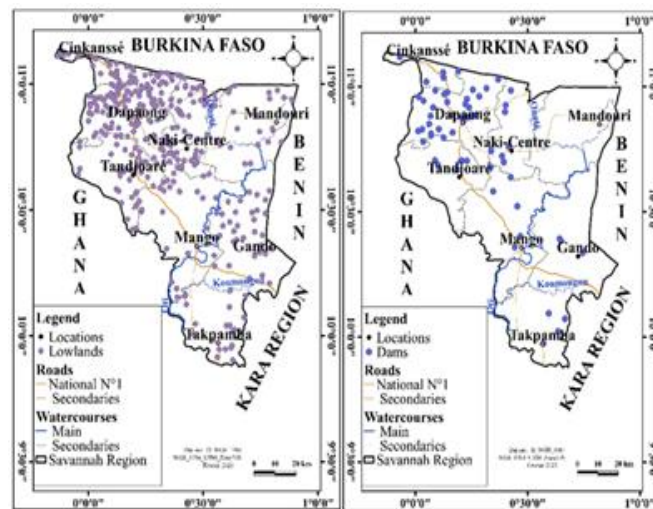


Figure 2: Location of lowlands and reservoirs/dams.

This figure shows that the Savanes Region has a great potential for lowlands and water reservoirs around which various agricultural activities take place.

Overview of activities around dams and lowlands

Three (03) categories of crops are grown around the lowlands and reservoirs, as shown in figure 3 below.

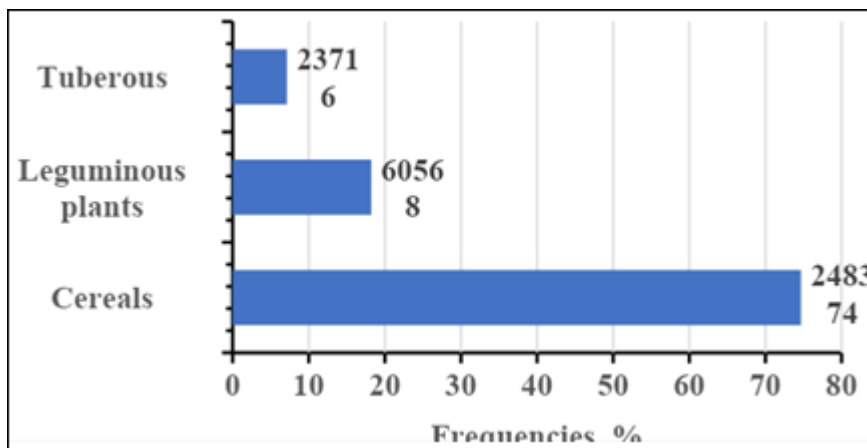


Figure 3: Categories of crops grown in the Savanes region

Analysis of figure 3 shows that crops grown in the Savanes Region revolve around cereals, pulses and tubers. Cereal production takes first place with 248,374 tons, or 74.66% of total production. Pulses followed with 60,568 tons, or

18.21%. Tubers accounted for only 7.13% of production, or 2,316 tons. Cereal production in this region is characterized by a variety of crops. The most recurrent crops are sorghum/millet, rice and maize, as shown in figure 4.

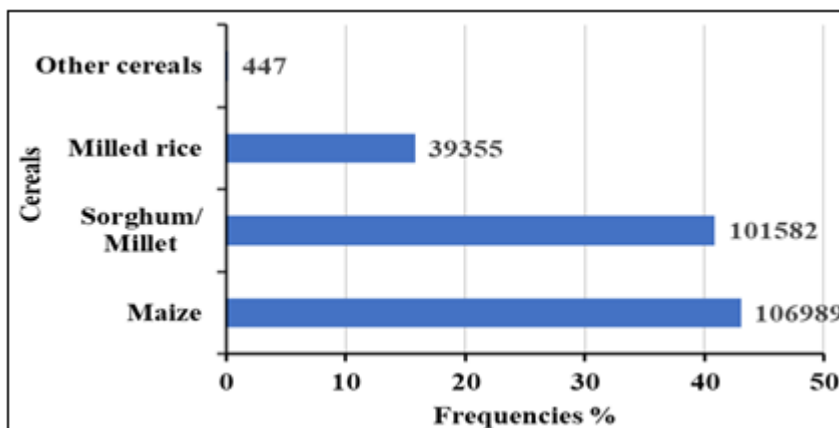


Figure 4: Cereal production in tons

Figure 4 shows trends in cereal crop production. Corn production slightly dominates (106989 tons), i.e. 43.08%. Sorghum-millet accounts for 40.90% (101582 tons). Milled rice accounts for 39,355 tons (15.85%). Other cereals such as fonio and paddy rice account for less than 1% of production, with 447 tons. In addition to cereal production, tubers and pulses are also grown in the lowlands and around the region's reservoirs.

The most represented tuber is yam, with 1,394 tons of production (58.63%). Cassava follows with 9422 tons (39.73%). Other tubers such as sweet potatoes and taro account for 390 tons (1.64%).

The last category of agricultural production is legumes (figure 6), the majority of which are grown in market gardens. These include beans, groundnuts and many others.

Figure 5 below shows that yams and manioc are the tubers most often produced.

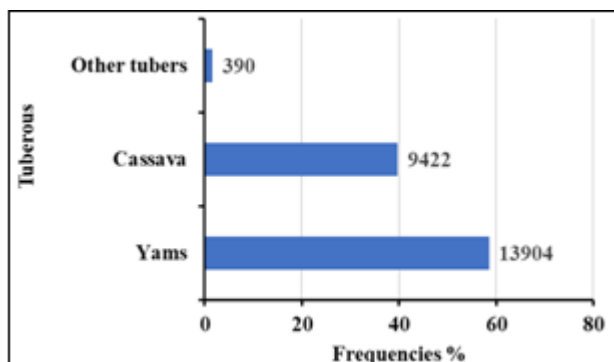


Figure 5: Tuber production in tons

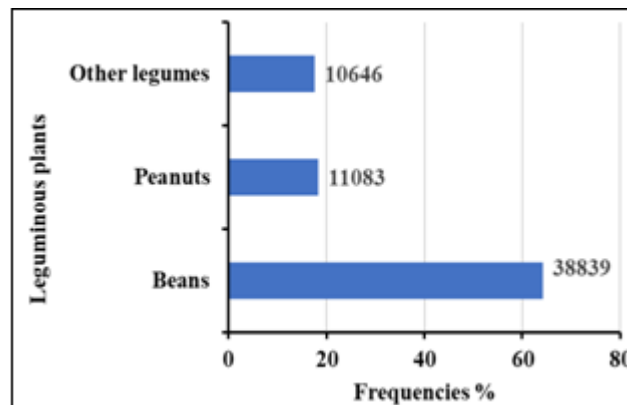


Figure 6: Legume production in tons

Bean production dominates the leguminous sector, with

38839 tons(64.12%), compared with groundnuts, which account for 11083 tons(18.30%). Voandzou and soybeans are the other legumes grown, accounting for 17.58% of production (10,646 tons).

Regional production

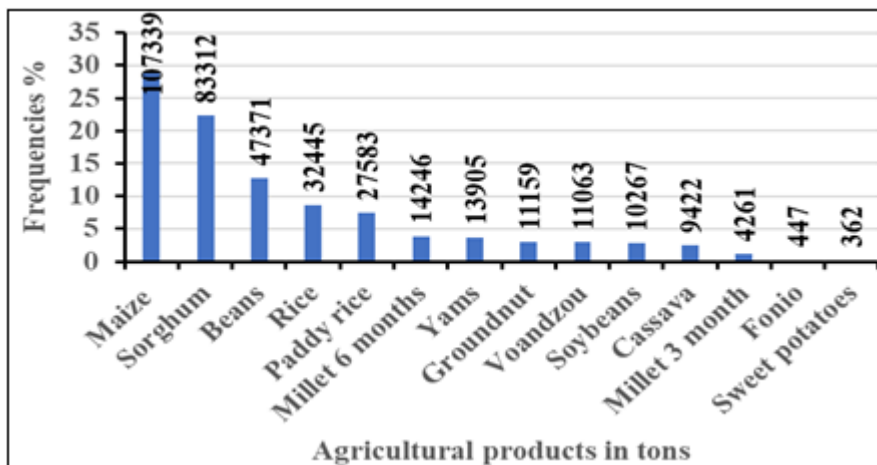


Figure 7: Regional production in tons

This analysis reveals three groups of agricultural products in relation to the quantity of regional production. The first group is made up of the most widely grown products, namely maize (107339 tons, 28.76%) and sorghum (83312 tons, 22.32%). The second group includes medium-grown products: beans (47371 tons, 12.69%), rice (32445 tons, 8.69%) and paddy rice (27583 tons, 7.39%). Millet 6 months old, yams, groundnuts, voandzou, manioc soybeans, millet 3

months old, fonio and sweet potatoes make up the third group, whose production is low and varies from 1,246 tonsto 362 tons.

Agricultural production by prefecture

Figure 8 shows the distribution of agricultural production by prefecture.

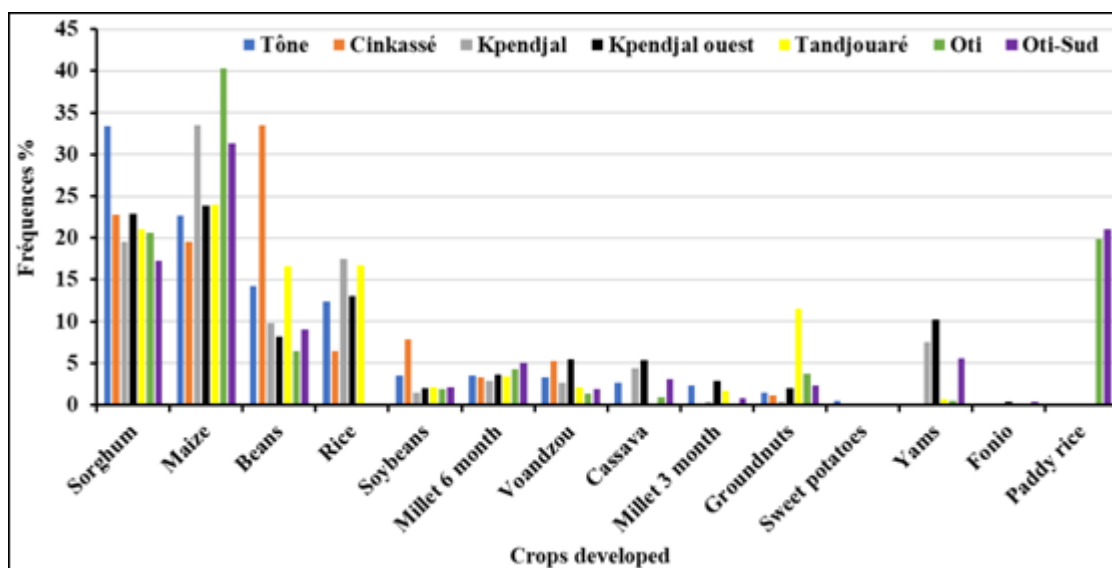


Figure 8: Agricultural production by prefecture in tons

Analysis of this diagram shows that sorghum is the main crop in the Tône prefecture (19,589 tons, or 33.41%). It is followed by maize, with production of 13,269 tons (22.63%). Medium crops are beans (8333 tons, 14.21%) and rice (7285 tons, 12.42%). In the Cinkassé prefecture, bean production dominates with 12,168 tons(33.52%). Sorghum follows with 22.74% (8256 tons) and maize 19.58% (7109 tons). Other crops (soya, voandzou rice, millet, etc.) are poorly represented. In the Kpendjal prefecture, on the other hand, maize production predominates with 18,438 tons(33.55%). It is followed by sorghum (10741 tons or

19.55%) and rice (9615 tons or 17.50%).

Beans, yams and manioc are less widely grown. In Kpendjal-West, maize (11,406 tons, 23.83%) and sorghum (10,962 tons, 22.91%) are the main crops. Rice (6237 tons, 13.04%), yams (4881 tons, 10.20%) and beans (3936 tons, 8.23%) are moderately represented. Other crops poorly represented are voandzou, cassava, millet, groundnuts, etc. In the Tandjoaré prefecture, corn, sorghum, rice, beans and peanuts are the main crops grown. Their representation varies from 24% or 9958 tonsto 11.55% or 4790 tons of production.

Millet, voandzou, soybeans, etc. are less widely grown. Production in the Oti prefecture is dominated by maize, with 23,281 tons or 40.33%. Sorghum and paddy rice follow with 11,889 tons (20.59%) and 11,492 tons (19.91%) respectively. Other products such as beans, millet, groundnuts, etc. are grown to a lesser extent. Paddy rice is grown only in the Oti and Oti-sud prefectures. In Oti-sud, paddy rice (1,691 tons, or 21.11%) is second only to maize (2,3878 tons, or 31.32%). Sorghum accounted for 17.26%, with 13157 tons produced. Other products such as beans, yams, millet, manioc and groundnuts are less well represented.

Vegetable production

Area (hectares) farmed by gender

A total of 287.17 hectares of lowlands are exploited by the population of the Savanes region.

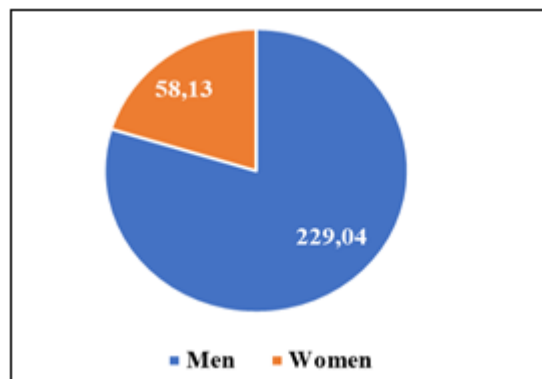


Figure 10: Regional area farmed by gender

This figure shows the distribution of farmers by gender. It shows that the majority of lowland farmers are men. Men farm 229.04 hectares (79.76%). Women, on the other hand, farm only 58.13 hectares (20.24%).

Prefectoral areas farmed by gender

The area farmed by gender in the prefecture is shown in figure 11 below.

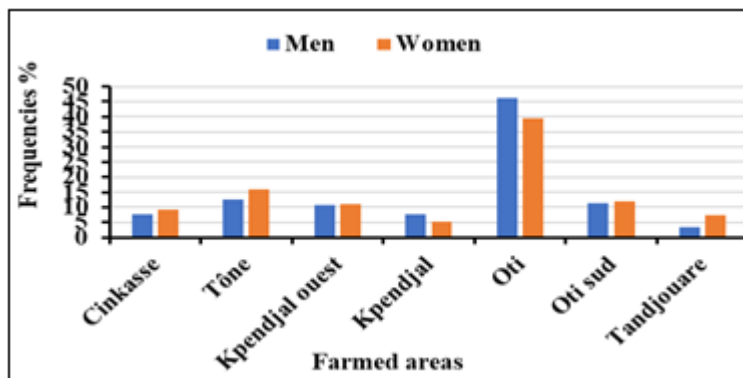


Figure 11: Prefectoral areas farmed by gender

According to this figure, the Oti prefecture covers the largest area, with 206.21 hectares (42.89%) farmed. Men farm 164.76 hectares (46.28%), while women farm 41.45 hectares (39.50%). In all the other prefectures of the Savanes Region, the proportion of lowlands farmed by men and women is less than 15%.

Production (Tons) by gender

Vegetable production by gender in the Savanes region is illustrated in figure 12 below.

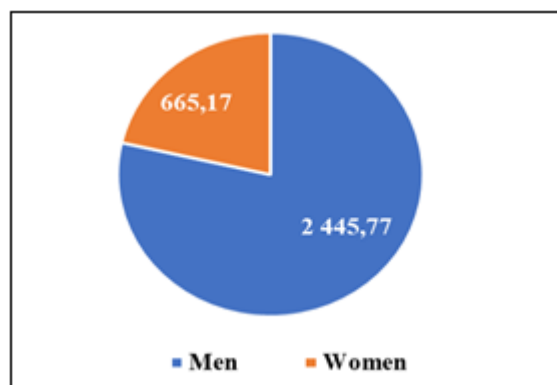


Figure 12: Regional vegetable production by gender

Men largely dominate market garden production (2,445.77 tons or 78.62%), compared with 665.17 tons (21.38%).

Prefectoral production by gender

Figure 13 below shows vegetable production by prefecture and gender.

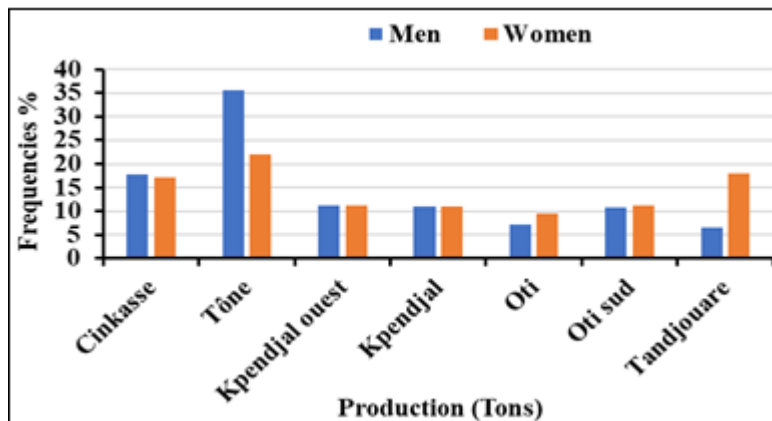


Figure 13: Vegetable production by prefecture and gender

Production income and food security in the Savannah Region

Figure 14 illustrates income from agricultural production.

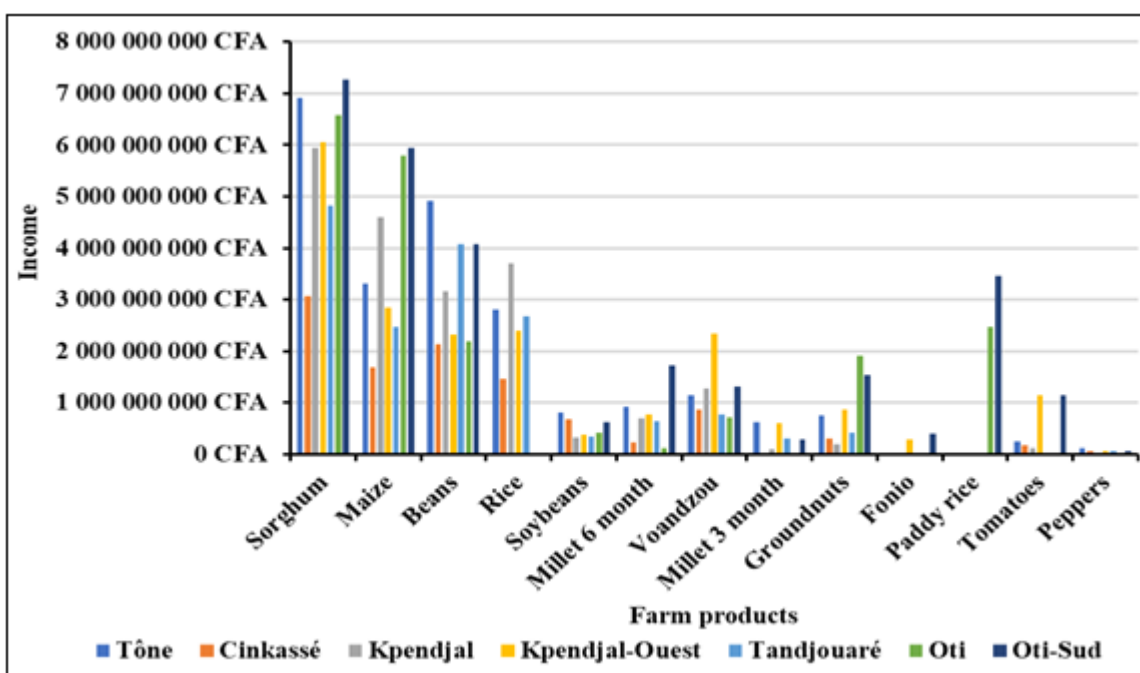


Figure 14: Income by crop in the prefectures

The figure shows that the crops that generated the highest sales for lowland farmers were sorghum (40,662,445,000 FCFA), maize (26,640,261,000 FCFA), beans (22,876,171,000 FCFA), rice (13,055,350,000 FCFA) and paddy rice (5,930,345,000 FCFA). The most profitable crops in almost all prefectures are sorghum, maize, beans and rice, with revenues ranging from three to eight billion CFA francs. As for paddy, it is only in the prefectures of

Oti and Oti-sud that it is produced, where farmers in these two prefectures earned an overall income of around three billion CFA francs.

These productions and incomes lead to food self-sufficiency, as illustrated in figure 15 below.

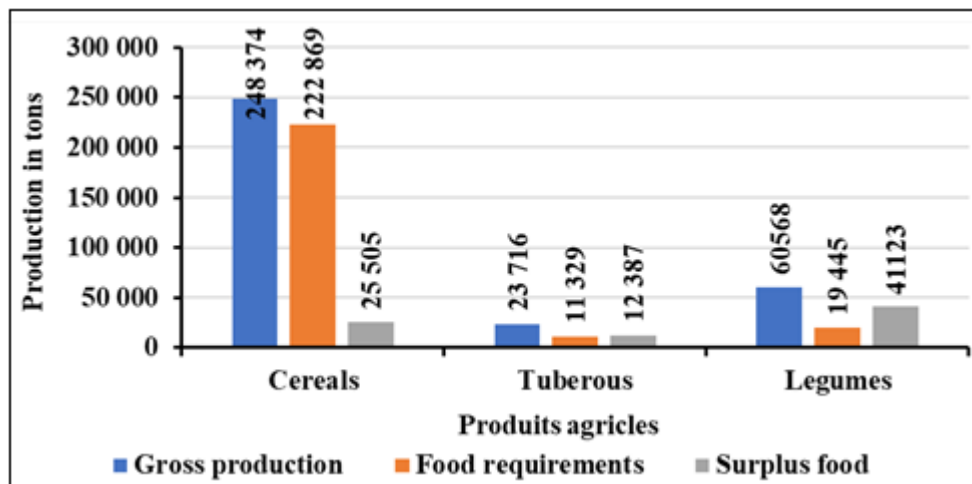


Figure 15: Food security in the Savannah region

Overall cereal production is 248374 tons, while the region's food requirements are 222869 tons. This gives a food surplus of 25505 tons. For tubers, overall production is 23716 tons against a food requirement of 11329 tons with a food surplus of 12387 tons. For pulses, the food surplus was 41123 tons, with food requirements (19445 tons) lower than overall production (60568 tons).

5. Discussion

Togo's Savannah Region is rich in potential lowlands and water reservoirs with fertile soils around which people grow a variety of crops. With their hydrological characteristics, these lowlands offer better conditions for cropping practices (A. T. Kindjinou, 2013). These findings are similar to those of K. Lare (2021), according to whom the lowlands of the Savanes Region are in great demand and are increasingly the object of intensive and growing exploitation. Not only are these lowlands favourable for farming, they also provide drinking water for the population and watering and fodder for animals. In line with the many ways in which inland valleys are used today, their exploitation is an interesting economic mutation for farmers who, according to K. Lare 2021, grow crops in the wet season, as well as off-season crops (market gardening) in the dry season. These results corroborate those of F. Kombieni *et al.* (2017). According to these authors, lowlands have an economic, scientific and cultural value that must be preserved. The various products from these lowlands have enabled the population to meet their food needs and obtain substantial income. While in the Savanes Region of Côte d'Ivoire, the exploitation of lowlands is essentially focused on rice and sugarcane production (P. D. Silué *et al.*, 2019), in Togo's Savanes Region, lowland farming is used to grow a variety of crops, including sorghum, maize, beans, rice, millet, etc. According to yield analyses (production/yield ratio), production in the lowlands of the Savanes Region is less than 07 tons per hectare. In Côte d'Ivoire, on the other hand, rice cultivation alone provides around 10 tons per hectare, with three (03) harvests per year, according to the author. Togo, too, needs to adopt these new production techniques in order to boost yields. Nevertheless, in 2014, in the Savanes Region, half of rice farmers (53%) cultivated an area of less than one hectare, 23% farmed one to three hectares, 16% farmed five hectares and only a few farmers owned more than five

hectares (K. Lare, 2021). On the other hand, five years on, even if the minimum size of some farms is 1 to 03 hectares at the level of individual farmers, there is now a multitude of cooperative groupings that can farm more than 20 hectares each. For example, in 2014, rice yields ranged from 1,800 kg to 4.5 tons per hectare of paddy rice. According to the author, small producers can earn up to 450,000 FCFA in income. On the other hand, at the end of the 2019-2020 agricultural season, the dominance of cereal production in the Savanes region is linked to the fact that cereals are at the forefront of the population's dietary habits. Staple products include corn, sorghum, beans and rice, which can earn up to eight billion CFA francs regionally. Tubers include yams, manioc and sweet potatoes, often planted in early winter. These results are similar to those of K. Lare, (2021), according to whom sweet potatoes grown on mounds at the beginning of the wintering season provide an important food or income supplement. Legumes are food supplements that often accompany tubers and cereals. For the most part, they are market garden produce, generally grown in the off-season. Market garden produce occupied hectares in 1989, according to K. Lare (2017), where the average annual income ranged from 65,000 FCFA to 25,41,000 FCFA. Today, however, this area has increased to 287.17 hectares, providing an average income ranging from 3110950 FCFA to 2955402500 FCFA.

6. Conclusion

The demographic explosion leading to the occupation and depletion of arable land in the Savanes region has forced the population to turn to lowland farming. This new agricultural orientation enables farmers to increase their production and income. Many farmers are now turning to lowland farming to boost their economy and meet their own needs. This analysis also shows that inland valleys are highly productive in this region. We note that their development is not only the prerogative of men, but also of women. This is the case with market gardening, where although men dominate production, women make no effort to carve out a place for themselves in this sector. Thus, the different practices around these wetlands by different farmers show that lowland farming is economically profitable. The socio-economic benefits of inland valley development are reflected in a significant level of financed income, followed by improved

dietary conditions and better access to basic social services. Given the advantages of inland valleys, how can we explain the conflicts that often arise between farmers and livestock breeders over their management and use?

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Author Profile



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